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RESOURCE PRODUCTIVITY IN MILK PRODUCTION ON MIXED DRYLAND FARMS IN NAGAUR DISTRICT (RAJ.)

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ABSRTACT

Resource productivity of dairy cows on dryland farms in Nagaur district of arid western Rajasthan was examined for 1977-78 to 1979-80. Fixed cost and labour required subtractive corrective measures togetherwith appropriate increases in feeds and fodder to improve the milk productivity on mixed dryland farms.

INTRODUCTION

Milk production in the state of Rajasthan (2.8 million tonnes, 10 per cent of India's total production) comes from a large cattle population (7 per cent of the country's total), mainly in its western parts. The productivity is low, apparently due to low yielding non-descript breeds, shortage of feeds and fodder and traditional management practices. Dairy cattle farming in Nagaur District of western Rajasthan is relatively a recent enterprise under the influence of a national project "Operation Flood", offering assured market for milk.

Production of milk depends on feeding, breeding and management of the animals. In most of the production function studies in past, variables like feeds and fodder, labour, type of breed, building and equipments (Heady et al. 1964; Jacob et al. 1971; Aul et al. 1974; Chhikara and Gangwar 1975; Singh and Jha, 1975; Sankhayan and Joshi 1975; Kumar and Singh 1980; Rao, 1985) were used. Additionally, factors like age at first calving, service period, advancement of lactation, frequency of milking and body weight of animals also affect the milk production.

The knowledge of relative importance of the different inputs influencing milk production is very imprortant to effect improvement in resource productivity. A study was undertaken to estimate the resource productivity coefficients in milk production; to determine the marginal value productivities of different inputs used in the milk production and to examine the resources allocative efficiency in milk production.

MATERIAL AND METHOD

The study was based on the data collected from 113, 82 and 83 samples of mixed dryland farms in three categories viz., small (0-4 ha), medium (4-8 ha) large (above 8 ha) spread over six villages. namely Inana, Bhadana, Rinyasyamdas

Palri-jodha, Kharda and Lamba Jat of Nagaur district in western Rajasthan. Data related to three consecutive years i. e. 1977-78, 1978-79 and 1979-80, respectively representing good, average and drought years depending on the amount of rainfall received during the crop growth periods in these years (Shastri and Ramakrishna, 1980). The input-output fortnightly data for cow milk production (cattle breed "Nagauri") were collected throughout the period of investigation following the cost accounting method.

The Model

Four forms of production functions of following algebric expressions were considered :

Linear : $Y = a + b_1x_1 + b_2x_2 + \ldots + b_nx_n + u$ ... (i)

Cobb-Douglas : $Y = a\, x_1^{b_1} x_2^{b_2} \ldots x_n^{b_n}\, u$ ... (ii)

Semi-log : $Y = \log a + b_1 \log x_1 + \ldots + b_n \log x_n + u$ ... (iii)

Exponential : $\text{Log } Y = a + b_1x_1 + b_2x_2 + \ldots + b_nx_n + u$ ... (iv)

Where 'a' was intercept, x_1, x_2 ... x_n and, b_1, b_2 ... b_n were respective explanatory variables and regression coefficients. In the present case, the determinants for explaining variance in milk production included were as follows :

Y = Value of milk produced per animal per day (Rs)
x_1 = Expenditure on fodder per animal per day (Rs)
x_2 = Expenditure on concentrates per animal per day (Rs)
x_3 = Value of human labour used per animal per day (Rs)
x_4 = Fixed cost per animal per day (Rs)
x_5 = Dummy variable for season I
D_1 = 1 for season I, 0 for others
X_6 = Dummy variable for season II
D_2 = 1 for season II, 0 for others
U = Random error

Variable x_1 (fodder) excluded the fodder grazed, but included on-farm fodder supplies or the quantities purchased by the farmers if any, valued at prevalent rates. The total value of fodder consumed during the reference years was transformed per animal per day for different seasons.

Feeds (x_2) included values of farm produced or purchased grains (pearl millet and guar), sesame oil and/or oil cake and jaggery at prevalent prices.

Human labour (x_3) accounted the family as well as hired labour man-hours used for maintenance of animals at the prevalent rates.

Fixed costs (x_4) in milk production function included depreciation and interest on fixed livestock investment made by farm families.

x_5 and x_6 represented lean season (season I) and flush season (season II) dummies, respectively. The lateral season was represented by intercept of the function in order to avoid dummy-trap.

All factors influecing the milk output were assumed to be covered by the variables considered.

The milk yield per animal (Y) during different seasons and valued at the prevalent prices, was taken as dependent variable for milk production function analysis.

For the selection of 'best-fit' from amongst these functions, the signs and stability of regression coefficients and values of R^2 were examined simultaneously.

In 7 out of 1 2equations, milk production function followed log-linear production logic (Table 1). Barring the drought year (1979-80) milk production pre-dominantly followed log-linear specification. Only at the small farms in the good year (1977-78) and at the large farms in drought year (1979-80) the milk production followed semi-log production function.

Table 1 Values of R^2 (Square of multiple correlation) x 100 in relation to different forms of milk production functions, 1977-80

Year	Form of functions			
Farm size	Linear	Cobb-Douglas	Semi-log	Exponential
1977-78				
Small	41.69	48.93	49.07	38.59
Medium	21.41	36.97	32.03	17.21
Large	31.75	42.06	27.35	34.43
1978-79				
Small	32.68	52.34	40.34	40.41
Medium	29.71	47.35	33.31	38.61
Large	24.34	34.49	29.84	24.11
1979-80				
Small	49.63	82.59	78.21	53.17
Medium	44.05	33.82	43.04	32.40
Large	37.05	30.41	42.35	22.38

Table 2. Milk production functions on different sizes of farms (1977-80)

Variables	1977-78			1978-79			1979-80		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
No. of observations	28	63	78	24	36	42	12	42	51
Constant log 10	0.7371	−0 7661	0.4334	0.6444	1.0363	1 3384	0.1951	0.6450	1.2477
Fodder (x_1)	0 1924	−0.7661**	0.1177	− 0.2238	(0.0277	0.3575	0.8206	0 4050	−0.1718
	(0 2641)	(0.2803)	(0 1955)	(0.3453)	(0 2140)	(0.2398)	(0.7170)	(0,4924)	(0.4062)
Feeds (x_2)	0.239_*	0.6323**	0.7008**	1 0218**	0.5799**	0.5032**	1.5992*	0.6465**	0,3746**
	(0.0921)	(0.1192)	(0.1093)	(0.2874)	(0.1769)	(0.1465)	(0.4509)	(0.1885)	(0.1356)
Labour (x_3)	−0 1788	−0.1212	− 0.5036*	0.5385	1.3978**	−0.0541	−1.6634	− 0.1052)	0.0031
	(0.1707)	(0.2329)	(0.2612)	(0.4446)	(0 4401)	(0 2838)	(1.3212)	(0.5510)	(0 3342)
Fixed cost (x_4)	0.3881	− 0.3752	− 0.3515	−1.1146	−0.8490	1.1782*	−1.3486	−0.6001	0.9080
	(0.2229)	(0.4236)	(0 5160)	(0.9444)	(0.6470)	(0 5617)	(2.3887)	(1·3534)	(0 7516)
Season I (x_5)	0.0902	−0 3413*	−0.3057*	−0 0854	− 0 4053	0.1345	0.6602	0 1159	−0.1976
	(0.1062)	(0.1592)	(0.1359)	(0.2746)	(0.1865)	(0.1886)	(0.5081)	(0.3586)	(0.3156)
Season II (x_6)	0.0200	−0.1584	−0 1405	0.2034	− 0 0947	− 0.0672	−0.1372	− 0.3715	0.0889
	(0.0901)	(0.1350)	(0.1217)	(0.2515)	(0.1741)	(0.1222)	(0.3415)	(0.2266)	(0.1467)
R^2 x 100	48.93	36.97	42 06	52.34	47.35	34.49	82.59	33.82	30.41
$R-^2$ x 100	37.33	31.45	38.04	39.11	38 58	25.39	68.08	24.63	22.68
'F' value	3.517**	5.474**	8.590**	3.112*	4.347**	3.071*	3.953	2.981*	3.205

Figures in parentheses indicate errors of regression coefficients

* Significant at 5 per cent level

** Significant at 1 per cent level

Preponderance of log-linear specifications in most cases was decisive for its retention for further analysis of the results (Table 2). The selection of 'best fit' was followed by scanning zero-order correlation matrix for multi-collinearity. The correlations were not strong and, thus, were of no concern.

RESULTS AND DISCUSSION

Fodder availability at farms, in general, failed to register any significant impact upon milk production (Table 2). This implied that production of milk in Nagaur district depended predominantly on bio-mass productivity of the concerned grazing lands. There was a singular case of negative and highly significant role of fodder in causing variances in milk production on medium size farms. It was so probably due to the low nutritional quality of available fodder or due to abundant supply of fodder which gave diminishing impact on milk production. The exclusion of grazing in production function analysis appears to have suppressed the efficiency of available fodder resources.

Table 3 Marginal value productivities of input factors in milk production 1977-80

Farm size & Years	Fodder (x_1)	Feeds (x_2)	Human labour (x_3)	Fixed cost (x_4)
Small				
1977-78	1.18	2.45*	-1.12	3.22**
1978-79	-1.68	13.92**	2.93	-7.84
1979-80	1.18	13.56**	4.78	-5.85
Medium				
1977-78	-2.52**	3.79**	-0.43	-1.76
1978-79	0.12	8.15**	6.17**	-5.16
1979-80	0.66	7.93**	-0.41	-2.98
Large				
1977-78	-0.49	5.13**	-2.49*	-1.61
1978-79	2.20	6.56**	-0.43	9.99*
1979-80	-0.52	6.29**	0.70	8.03

* Significant at 5 per cent level ** Significant at 1 per cent

Feeds appeared to exert uniformly positive and significant effect on variation in milk production, irrespective of temporal and farm size variations.

As seen from the coefficients generated for human labour input, the milk production remained, by and large, unproductive when related to labour input. It, thus, seems logical to conclude that labour input in milk production is in surplus supply in Nagaur district and needs to be made into a balanced preposition.

Fixed cost had significant and positive contribution on small farms in good year (1977-78) and on large farms in average year (1978-79).

The seasonal effect on the cow milk production was significantly negative in lean season for medium and large sized farms in good year (1977-78) and medium size-group in average year (1978-79). No impact was, however, discernible in drought year (1979-80). The dummy variable representing flush season could not capture any meaningful impact. From the results of seasonal dummies, it seems that traditional milk seasons in arid areas on dryland farms did not generate significant variance. It is thus safe to hypothesise that in a good year with ensured fodder supply, the milk production in Nagaur district is not conditioned significantly by seasonality. It seems that there are certain variables not included in the model which have more strength of explaining variances in milk production.

Marginal Value Productivities

The marginal value productivities (MVP) for different resource input categories were calculated per rupee expenditure on inputs at geometric mean level from the regression coefficients generated in Cobb-Douglas type of milk production functions for different size of farms and years.

The fodder was characterised by high MVP coefficients on small farms in good (1977-78) and drought (1979-80) years and on large farms in an average (1978-79) year indicating that additional expenditure on fodder on these farms in such years will increase the total output. Negative marginal value productivity in good year on medium farms and, in good and drought years on large farms indicating the excess use of fodder suggest need to reduce the fodder quantities on these farms for enhanced value productivity of fodder resource.

MVP coefficients for feeds were positive, highly significant and more than unity for all the three survey years indicating thereby the need for additional feed for increased milk production.

MVP coefficients for human labour used for maintenance of cows were positive on small farms excepting good year (1977-78). On medium farms only in the average year (1978-79) MVP coefficient was positive and highly significant suggesting for additional use of human labour for milk productivity enhancement. In majority of cases medium and large farms had negative MVP coefficient indicating excessive use of human labour and suggest curtailment in this resource for optimum use.

MVP coefficients for fixed cost, excepting on small farms in good year (1977-78) and on large farms in average year (1978-79), were negative, signifying in general, need for their curtailments.

Conclusion

The resource productivity analysis of milk production reveals that barring few aberrations the milk production logic in short-run is efficiently described by log-linear specification. From MVP coefficients it can be concluded that fixed cost and labour would need subtractive corrective measures. Finally, the milk production efficiency can be enhanced by suitable adjustment in feed and fodder and simultaneous reductions in fixed costs and labour.

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